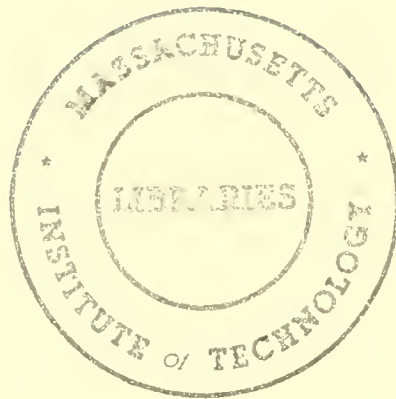


BASEMENT





**WORKING PAPER
ALFRED P. SLOAN SCHOOL OF MANAGEMENT**

Project performance and the Locus of
Influence in the R&D Matrix

Ralph Katz
Thomas J. Allen

July 1981 WP No. 1233-81

**MASSACHUSETTS
INSTITUTE OF TECHNOLOGY
50 MEMORIAL DRIVE
CAMBRIDGE, MASSACHUSETTS 02139**

RESEARCH PROGRAM ON THE MANAGEMENT OF RESEARCH, DEVELOPMENT AND
TECHNOLOGY BASED INNOVATION

Project performance and the Locus of
Influence in the R&D Matrix

Ralph Katz
Thomas J. Allen

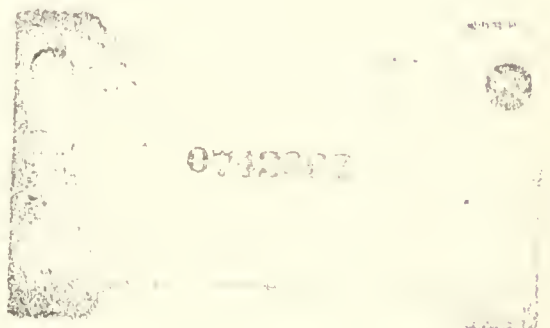
July 1981 WP No. 1233-81

The research reported in this paper was supported by a grant (DASG 60-77-C-0147) from the Chief of Studies, Management Office, Department of the Army. The authors wish to thank the technical staffs and managements of all participating organizations for their cooperation and assistance in the study.

M.I.T. LIBRARIES
AUG 14 1981
RECEIVED

ABSTRACT

In an R&D setting, this study examines the relationships between project performance and the relative influence of project and functional managers for almost 100 matrixed teams across ten different technology-based organizations. These performance relationships are investigated for several areas of influence within the project team as well as for influence in the overall organization. Analyses show that performance is highest when internal project influence is perceived as balanced between project and functional managers but when external organizational influence is considered centered in the project manager. Performance gradually declines the further one moves away from this combination.



INTRODUCTION

The matrix structure as used in research and development organizations is an inherently unstable form of organization. Implicit in this structure is the need for the resolution of two opposing sets of forces. One of these can be best described as an "output-oriented" set of forces directed towards getting the product of the R&D team out the door and into the marketplace or into manufacturing. Typically, such pressures are controlled by the project or program manager's office since they are accountable for successfully transferring product outputs within established schedule and budget constraints.

The second set of forces can be described as "input-oriented". These forces are controlled by the functional or disciplinary arm of the organization and are concerned primarily with project quality and the incorporation of the most current technology in product or process developments. The advantage of a functional organization lies in its emphasis on technical excellence.

The matrix design tries to capture the strengths of both structures by formally recognizing and incorporating both sets of forces. The conflicts produced by such a structural model are not necessarily harmful for the organization; in fact, they can be very beneficial provided the forces are reasonably well balanced. If, however, the "input" component is allowed to dominate development work, the product is likely to incorporate more sophisticated but also perhaps less proven and less

reliable technology. The development will also be less likely to be completed on time since engineers can always "make it a little bit better" given some additional time (Marquis, 1969). This natural reluctance to release a product development and the temptation toward the use of more attractive advanced technology must be countered by forces that are more sensitive to market needs and are concerned with moving the project into physical realization (Mansfield and Wagner, 1975; Utterback, 1974).

If the "output" set of forces becomes dominant, there is the likelihood that sacrifices in quality may be made in order to meet budgets and schedules. Product potential may even be oversold beyond the organization's current technological capability. Moreover, should the project management component of the matrix become overly dominant, there is a very real threat to the long term technological capability of the organization. As discussed by Allen (1977), there is a strong tendency to deemphasize supporting technological efforts to meet current short term goals which could, thereby, mortgage future capabilities.

While a great deal is currently being written about matrix organizations (e.g., Souder, 1979; Hill and White, 1979), almost no research has systematically investigated the effectiveness of these structures. Is it likely that a balance between input and output oriented forces will actually result in improved performance? In an attempt to answer this question, the present research examines connections between project performance and the relative dominance of project and functional relationships for almost 100 matrixed project teams from ten different technology-based organizations. The basic hypothesis throughout this study is that balanced influence between

project and functional managers will result in higher performing projects.

Areas of Influence

In a matrix setting, there are a number of important areas in which project and functional managers contend for influence. Moreover, the extent to which one of the managers is seen as having considerably more influence than the other will have a strong bearing on both behaviors and attitudes within that setting. In the present study, four important areas in which both project and functional managers exert influence are considered to test the degree to which the locus of influence in each area is related to project performance. Three of these areas concern influence directed inwardly toward the project team while the fourth deals with influence in the larger organization. The four areas of perceived influence are as follows:

- 1) Project Work: Influence over the details of the individual engineer's project work.
- 2) Salaries and Promotions: Influence over the salaries and advancements of engineers assigned to the project.
- 3) Personnel Assignment: Influence over assignment of specific engineers to the project.
- 4) Organizational: Influence within the larger organization outside the project group.

Details of Project Work

At first thought, it would be natural to assume that project managers, being ultimately responsible for project performance, should have more control over the details of the work on their project. On the

other hand, it is the functional managers who are usually accountable for the integrity and quality of the project's technical content. To balance the influence of both of these managers in this area is often a difficult task. While an engineer may supposedly report to both managers in a formal sense, the degree to which both managers are actively influencing the direction, clarification, or the pursuit of technical details and solution strategies will vary considerably from project to project depending, of course, on the project manager's ability and even willingness to become involved in such details. Such involvement depends, at least in part, on his conceptual and applied understanding of the relevant technology as well as his ability to provide meaningful and constructive feedback and assistance as the technical work progresses. In any event, it is hypothesized that project performance will be higher when both project and functional managers are exerting equal influence on the project work of matrixed engineers.

Salaries and Promotions

Advocates of matrix organizations (e.g., Kingdon, 1973; Sayles, 1976; Davis and Lawrence, 1977) have long argued the importance of achieving balance in this area. It is suggested, quite plausibly, that should the engineer see either his project or functional manager having more control over chances for salary increase and promotion, then that manager alone is more likely to influence and direct the engineer's behaviors and priorities. This is one of the key issues in what are often described as "paper matrix" situations: management assumes that by describing a balanced situation on an organization chart, and by describing the responsibilities of the two sets of managers, balance will

be achieved in the organization. In practice, however, one of the two components of the matrix comes to dominate or appears to dominate in such key areas as determination of salaries and promotions. From the engineers point of view, this dominant component is the only one that counts. The other exists merely on paper. The result is not a true matrix but either a project or functional organization, depending on which element appears dominant.

It is important to stress that it is the appearance that counts. In many cases, both sets of managers may be equally influential in determining the actual pay increase. If only one manager, the department head for example, calls the engineer into his office to announce the raise, the project manager's involvement will not be apparent and the engineer will come to believe that it is only the department head who counts. Engineers can acknowledge and recognize the existence of two lines of reporting, but unless they see both managers controlling their progress in terms of income and status, there will be a natural tendency for them, particularly in conflict situations, to heed the desires of one manager to the neglect of the other. The matrix then ceases to function, resulting in a structure that is more likely to resemble the pure project or functional form of organization despite any "paper" claims to the contrary.

Given that management has decided that a matrix form is desirable and that engineers correctly perceive its existence (at least theoretically), higher performing projects should be those in which engineers see both project and functional managers controlling salaries and promotions to an equivalent degree.

Personnel Assignments to the Project

Personnel assignments are another traditional area of combat in the matrix organization. Project managers generally see themselves as competing for a very scarce resource, viz., technical talent. Each of the functional departments will have a variance in the degree of technical talent which it can make available to the project. Quite naturally, a project or program manager will want as many top performers as possible to be assigned to his effort. This is, of course, an impossibility. Often added to this problem is the desire of functional managers to get many of their lower performers off their overhead accounts and onto project budgets.

Should project management control this process exclusively, assignments will be made solely on the basis of project priority, with little regard for individual development and less concern for the success of the large number of lower priority projects, which can in the long run determine organizational success or failure. Witness in this latter instance the cases of some aerospace firms which have been very successful with certain high priority projects only to see the overall organization in deep technical and financial trouble within a few years. Allowing high priority projects to unduly strip talent from other efforts can be very harmful to the organization over the long run.

On the other hand, if personnel allocation is left entirely to the functional managers, then the specific needs of each project cannot be met to the same degree. Only the project managers have the detailed information about project needs that are necessary to make proper personnel assignments. To properly match the engineer to the job, then, requires a joint effort. Project managers may be better able to

understand the detailed needs, but functional managers are more aware of the particular talents available among their staff. More highly evaluated projects, therefore, should be those in which personnel assignments are influenced by project and functional managers to an equivalent degree.

Organizational Influence

In a matrix structure, power should be viewed as evenly divided between project and functional components. If either is seen to dominate, the engineer will soon conclude that it is that manager's desires which will win out in the long run. Since most engineers see their organizational future as dependent on being on the "winning team", it doesn't require much imagination to determine which manager will have greater influence over them. As previously discussed, an imbalance in organizational influence should lead to an overemphasis in one of the reporting relationships, either in the functional input side or in the project output side. Furthermore, as engineers pay greater attention to one side of their work, the importance attributed to the other side deteriorates, resulting in lower project performance. The more highly evaluated projects, therefore, should be those in which engineers perceive an even balance in organizational influence between the project and functional components of the matrix.

Managerial Functions

While the three dimensions of internal influence are reasonably clear in their operational meaning, the question of organizational influence is more difficult to define explicitly. On what basis do

engineers decide whether the project or functional manager has more organizational influence or whether they are equal.

Likert (1967) has described an important function of a manager as providing a "linking pin" connection between his group and higher levels of management and thereby to the rest of the organization. In the present context, project and functional managers can both perform this organizational function as well as the additional function of linking the project team to its external professional reference groups.

In addition, project or functional managers must obtain and provide needed resources to the project team and must mediate various group conflicts that necessarily arise. These four functions pertain to managerial behaviors outside the project group, and the extent to which either the project or functional manager is seen as performing them may well determine which is perceived to have greater organizational influence. If the project manager is seen as more effective in carrying out some of these functions, then he may come to be viewed more dominant organizationally and vice-versa. From an exploratory standpoint, our research investigates the extent to which perceptions of organizational influence are associated with perceptions of how well project and functional managers are meeting the managerial functions that need to be performed in coupling the project team to its external environment.

In summary, Figure 1 illustrates the basic set of relationships being investigated by this study. The degree to which project and functional managers are seen as performing particular role functions results in certain distributions of both internal and organizational influence between these managers. These loci of influence, in turn, are hypothesized to affect project performance such that a more balanced

locus of influence is associated with higher project performance. These hypotheses will be examined for all projects as well as for projects within each of the different work sectors.

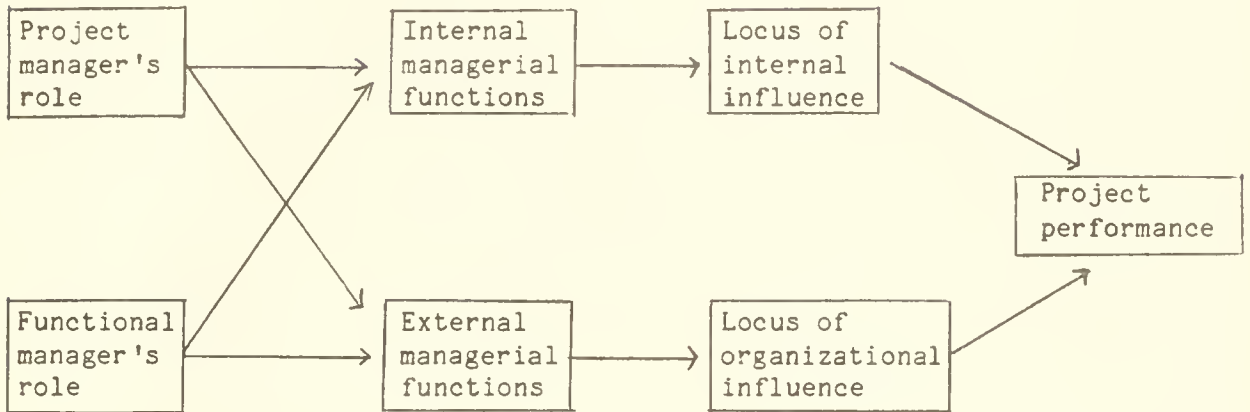


Figure 1. Relations Among Managerial Functions, Influence, and Project Performance.

RESEARCH METHOD

Setting

The data presented in this paper derive from a study of RD&E project teams in ten major organizations.¹ Although the selection of participating organizations could not be randomized, they were chosen to represent several distinct work sectors and markets. Two of the sites are government laboratories; three are not-for-profit firms receiving most of their funding from government agencies. The five remaining companies are in private industry: two from aerospace, two in electronics, and one operating in consumer goods.

In each participating organization, initial meetings were held with a cross-section of high level R&D managers in order to understand how the

organization was structured and to learn the local terminology for various reporting relationships, managerial and technical titles, etc. Short meetings were then scheduled with the professionals assigned to the projects to explain the purposes of our study, to assure them of anonymity, to solicit their voluntary cooperation, and to distribute questionnaires to each professional individually.² To make sure we had accurate project assignments, respondents were told to answer all questions in terms of the project assignment identified on the questionnaire's front page. If this was incorrect or not up-to-date, they replaced it with their correct project assignment. Questionnaires were also tailored to the particular reporting structure with language appropriate to each project group. Project managers, functional managers, and staff engineers and scientists received slightly different questionnaires reflecting their different role positions. Project managers, for example, were not given questions about themselves or about the functional managers of any of their matrixed staff.

Individuals were asked to complete the questionnaires as soon as reasonably possible. Stamped, return envelopes were provided so that completed forms could be mailed to the investigators directly. These procedures not only insure voluntary participation, but they also enhance high quality data since respondents must commit their own time and effort. The response rate across organizations was extremely high, ranging from a low of 82% to a high of 96%.

Although these procedures yielded over 2,000 respondents from 201 project teams, about half of the projects did not involve any part of a matrix design. Furthermore, none of the organizations was totally matrixed in the sense that all engineers and scientists had dual

reporting relationships to both project and functional managers. In fact, the degree to which professionals were part of a matrix structure varied considerably across organizations and even across projects within organizations. For the purposes of this paper, then, only projects in which at least 25 percent of the project members were actually in a matrix situation are considered. This gives a total of 104 projects.³ Respondents are considered to be part of a matrix structure when they report formally to separate project and functional managers, and when these two managers have no direct reporting relationship between them.

Matrixed Relationships

Respondents were asked to indicate (on seven-point, Likert-type scales) the degree to which their project and functional managers influenced: 1) the details of their project work; 2) their salary and organizational advancement; 3) their specific selection to work on the project; and 4) the overall conduct of the organization. For each of these influence areas, scale responses ranged from a "1" for "my project manager dominates"; to a "7" for "my functional manager dominates"; the middle point, "4", indicating that neither manager is dominant. For each question, individual member responses were averaged to calculate overall project scores for the four influence areas. In addition, responses to the three internal questions asking about managerial influence over affairs directly concerning project team members were combined to yield an overall project score for internal influence. As described by Katz and Tushman (1979), analysis of variance methods were used on all aggregated measures to insure the validity of combining individual perceptions to derive project scores.

For each influence area, if the averaged project score fell below 3.5, the project was said to be dominated by the project manager. Conversely, if the project score fell above 4.5, the project was categorized as dominated by the functional manager. When the average fell in the region from 3.5 through 4.5, the situation was said to be balanced between two managers. This somewhat restricted definition of "balance" was chosen to be sure that matrixed engineers did, indeed, mean that influence was equally distributed between project and functional managers. Sensitivity analyses, moreover, indicate that the findings presented in the "Results Section" are relatively insensitive to the scale width chosen to indicate a "balanced" situation.

Project Performance

Since comparable measures of objective performance have yet to be developed across different technologies, a subjective measure was used similar to that of Lawrence and Lorsch (1967), Allen (1977), and Katz and Tushman (1981). In each organization, project performance was measured by interviewing higher level management and asking each manager (at least one hierarchical level above the project and functional managers) to indicate on a five-point scale whether a project team was performing above, below, or at the level he expected of them. Each manager was asked to evaluate only those projects with which he was personally familiar and knowledgeable. Evaluations were made by individual managers independently and submitted confidentially to the investigators. On the average, each project was evaluated by between 4 and 5 managers. More importantly, the evaluations show a very strong internal consensus within each organization (Spearman-Brown reliabilities range from a low of 0.74

to a high of 0.93). As a result, individual manager's ratings are averaged to yield highly reliable project performance scores.⁴

Managerial Functions

To determine the factors underlying the engineers' perceptions of organizational influence, they were asked to indicate the degree to which project and functional managers:

- 1) have important and useful contacts with other professionals inside the organization.
- 2) have important and useful contacts with other professionals outside the organization.
- 3) are able to obtain resources necessary to carry out the project work effectively.
- 4) are effective at recognizing and mediating conflicts between groups and individuals.

As before, individual responses to these questions were averaged at the project level to obtain two project measures: one for project managers and one for functional managers. Finally, relative managerial differences were calculated for each project by subtracting the functional manager's ratings from those of the project manager. The larger the positive difference, the more project managers were rated over functional managers while large negative differences indicates higher ratings of functional over project managers.

RESULTS

As discussed in the Methods section, engineers' responses are used to clarify projects as either functionally dominated, balanced, or

project dominated with respect to each influence area.

According to the data, it is the project manager who has greater control over the details of the work in most project teams (Table I). Engineers on more than half the projects reported their project manager as being more influential than their functional manager in this regard. In fact, over 20 percent of the project teams reported that their project managers are almost completely dominant over this aspect of project affairs averaging less than 2.0 on this questionnaire item.

In sharp contrast to such project dominance, in almost 80 percent of

TABLE I

Distribution of Managerial Influence By Area As Perceived By Project Members				
Areas of Influence	Proportion of Projects Dominated by:			N
	Functional Manager	Balanced	Project Manager	
1) Internal Areas of Influence				
a) Project Work	21.7%	23.9%	54.4%	92
b) Salaries and Promotions	78.3	13.0	8.7	92
c) Personnel Assignments	47.0	22.7	30.3	66
2) Aggregate Internal Influence	44.6	35.9	19.6	92
3) External Organizational Influence	40.8	13.1	46.1	76

the projects, functional managers are seen to have more influence over salaries and promotions. Furthermore, in over 40 percent of the projects, members reported that their functional managers have almost exclusive control over these matters, averaging more than 6.0 on this item. With respect to personnel selection, functional managers also have more influence, although this time the differences are not as great. Functional influence continues to dominate even when responses to all three internal influence questions are averaged. In roughly 44 percent of the projects, functional managers are viewed as having significantly more internal influence than project managers. Almost 36 percent are perceived as balanced while only 20 percent of the project managers are seen as dominant internally. From the previous analyses, it is apparent that this functional bias stems primarily from control over salaries, promotions, and personnel assignments. Nevertheless, one might have expected greater involvement in these areas on the part of project managers especially in light of the project performance hypotheses.

In addition to these questions of influence over issues within the project team, matrixed professionals also indicated the degree to which functional and project managers had influence in the total organization. Responses to this question show very few balanced situations (Table I). Projects are almost equally split as to whether the project or functional manager is considered more influential within the organization. In only 13 percent of the cases were both managers seen as equal in organizational influence.

Project Performance

The distributions of Table I make it clear that balance is not

normal for any of the influence areas. In the vast majority of cases, either the functional or project manager is dominant. Yet, the critical hypothesis underlying the study posits that balanced conditions are more likely to be associated with higher project performance. To test this hypothesis and determine whether in fact the descriptive and normative situations are different, one must look at the mean performances of projects within each of the dominance categories.

In fact, a balance of influence over project work between functional and project managers is related to higher performance (Table II), albeit not quite significantly. On the average, project teams with dominant functional or dominant project managers perform lower. A similar pattern occurs in the area of salaries and promotions. Here, a balance also produces better results.

TABLE II

Mean Project Performance As a Function of the Locus of Influence Within Projects For Different Influence Areas				
Areas of Influence	Managerial Dominance			Sig. Level
	Functional	Balanced	Project	
1) Internal Areas of Influence				
a) Project Work	3.33	3.48	3.31	N.S.
b) Salaries and Promotions	3.31	3.57	3.45	N.S.
c) Personnel Assignments	3.30	3.36	3.39	N.S.
2) Aggregate Internal Influence	3.25	3.49	3.21	0.05
3) Organizational Influence	3.34	3.01	3.67	0.01

In fact, projects with dominant functional managers (the majority of the cases) constitute the lowest performing group. Exclusive functional influence over salaries and promotions, then, is not conducive to high performance even though such functional control is the general custom. With respect to personnel assignments, performance is unrelated to the locus of influence. Nevertheless, the results for the measures of aggregate internal influence clearly support the central hypothesis in that balance in influence over the internal functioning of the project team results in the best performance. Where either the functional or project managers are perceived to exert more internal influence, projects are significantly lower in performance than when the two are perceived to influence internal affairs to the same degree.

While a balanced state may be advantageous for internal influence, the parallel proposition regarding organizational influence is not only unsupported but strongly contradicted. Project performance is highest not when the managers are balanced but when the project manager is seen to have more influence within the organization. The balanced group of projects, in fact, produces the lowest performing results by a significant margin. Even when functional managers wield proportionately more influence, projects are higher performing than when organizational influence is balanced. At the same time, these functionally dominated teams do not perform nearly as well as projects with dominant project managers.

There remains the important question of causality. The data indicate that project managers who are seen to be more influential in the organization are likely to have more successful projects. It is also possible that project managers with more successful projects become, as a

result of their success, more influential in the organization.

To try to determine the causal direction, projects are subdivided by the length of time project managers had been associated with the projects. If the relationship between project manager dominance and performance holds true for those projects in which project managers have been associated for only a short period of time, then one can argue that the project's high performance is less likely to have resulted in a major increase in relative organizational influence for these managers. The causal direction, then, is more likely to have been from project manager influence to performance. This latter interpretation is supported when projects associated with project managers who have had less than two years of project tenure are analyzed separately from the rest of the sample (Table III).

TABLE III

Project Performance As a Function of Relative Organizational Influence of Project and Functional Managers By Project Manager's Tenure on the Project			
Project Manager's Tenure on the Project	Locus of Organizational Influence		
	Functional Manager	Balanced	Project Manager
a) Less than two years	3.22	3.07	3.56
b) Two or more years	3.45	3.35	3.74

Note: Subjected to a two-way ANOVA, only the main effects for organizational influence are significantly associated with project performance (F=2.61; DF=60; P<0.05).

Higher organizational influence by project managers is significantly associated with project performance regardless of the length of time project managers have worked with their projects. The logic underlying the two-year comparison is that it should take a project manager at least two years to develop a reputation for project success that would lead to greater influence in the organization. In other words, if project managers have been associated with their projects for less than two years and are considered to have a higher degree of organizational influence, it is unlikely that the performance of their current projects led to that status. There simply has not been sufficient time.

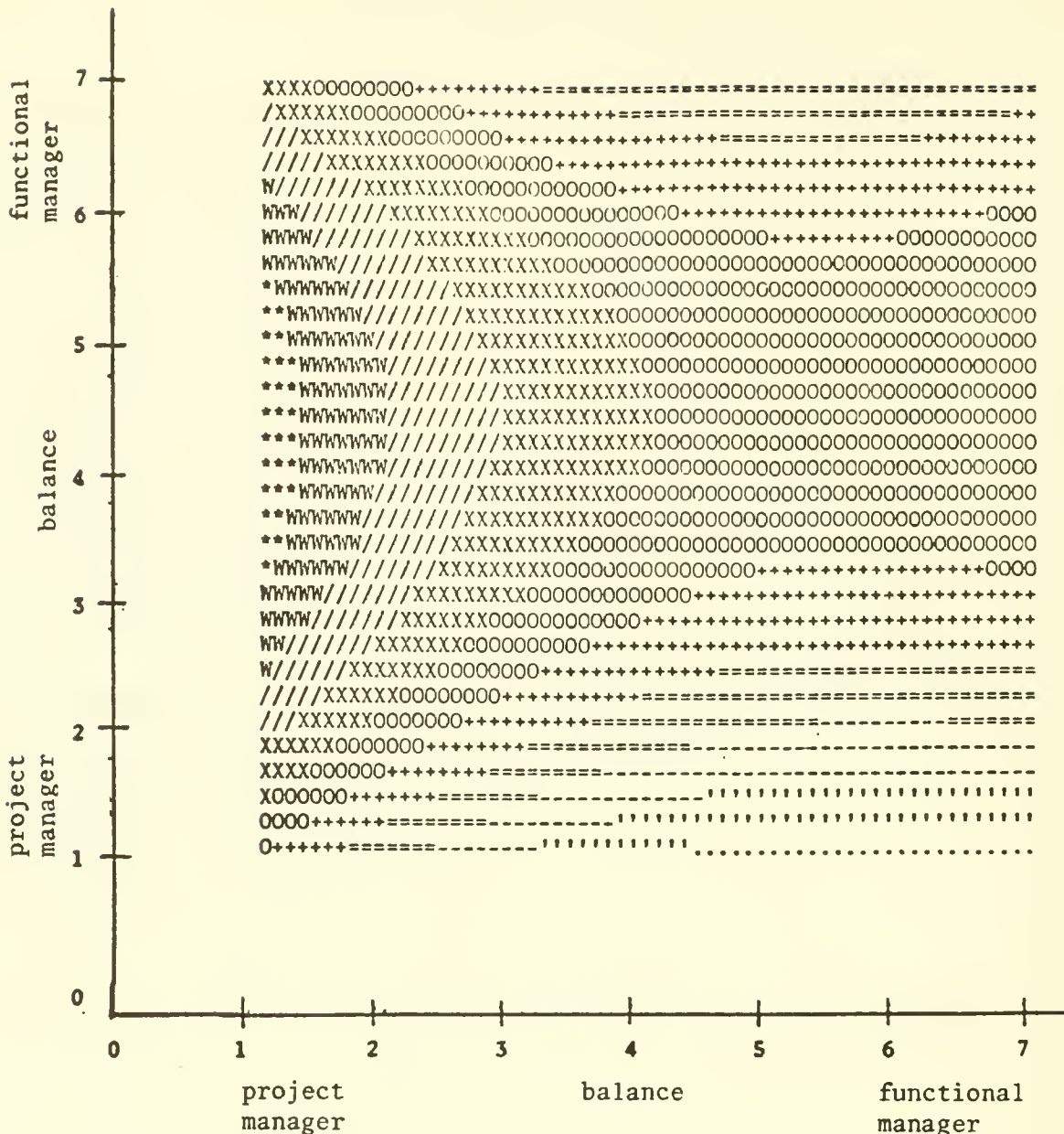
To summarize, the regression surface in Figure 2, shows how the loci of internal and external influence interact to produce project performance. In this three-dimensional contour plot, performance is maximized when internal project influence is balanced between project and functional managers and when external organizational influence is centered in the project manager. Performance gradually declines, however, the further one moves away from this combination.

Managerial Functions

While the three dimensions describing internal influence are well defined in this study, it is unclear why certain managers are seen as having more organizational influence than other managers. Perhaps managers who are viewed as more influential are able to perform certain external managerial functions more effectively. To clarify this issue, we compare respondents' perceptions of their project and functional managers across the locus of organizational influence.

The data in Table IV show that perceptions of the locus of

Internal Influence Over the Project Team



External Influence in the Organization

Project Performance is plotted as the Z axis according to the following scheme:

symbol	project performance	symbol	project performance
.....	2.24 - 2.34	000000	3.12 - 3.32
	2.34 - 2.53	XXXXXX	3.32 - 3.51
-----	2.53 - 2.73	/////	3.51 - 3.71
#####	2.73 - 2.93	WWWWW	3.71 - 3.91
++++++	2.93 - 3.12	*****	3.91 - 4.00

Figure 3: A Three Dimensional Contour Plot of Project Performance as a Function of the Locus of Influence Over Internal Project Affairs and the Relative Influence of Project and Functional Managers in the Organization.

organizational influence are related to all four of the managerial functions that were measured. Differences between the ratings of project and functional managers in terms of the degree to which they function as organizational or professional liaisons, resource allocators, or disturbance handlers, coincide completely with perceptions of organizational influence. Thus, when project managers are considered more dominant organizationally, they are also rated as more effective

TABLE IV

Mean Differences Between Project and Functional Managers' Ratings on Four Managerial Functions as a Function of the Locus of Organizational Influence

Managerial Functions	Perceived Locus of Organizational Influence			Sig. Level
	Functional Manager	Balanced	Project Manager	
liaison with organizational contacts	-0.63	-0.15	0.28	0.01
liaison with external professional contacts	-0.83	-0.22	0.30	0.001
allocation of resources	-0.26	0.12	0.41	0.01
resolution of group conflicts	-0.45	-0.11	0.23	0.01

Mean differences for each managerial function were calculated by subtracting team members' perceptions of their functional manager from their perceptions of their project manager. Thus, a positive difference indicates that project managers were rated higher than functional managers while negative differences indicate the reverse.

liaisons, having better and more useful contacts both within and outside the organization than their functional counterparts. They are, furthermore, seen as more effective in obtaining important resources and in handling with conflict situations with other groups.

On the other hand, when functional managers are considered more dominant organizationally, then they are seen as more effective in these same managerial functions than their project counterparts. In the balanced condition, perceptions of the two managers in these managerial functions are just about even as most of the mean differences are close to zero.

Based on these findings, one can argue that perceptions of organizational dominance are very much related to the relative differences between the two manager's ability to obtain resources, their skills at handling conflicts and their interpersonal contacts and associations both inside and outside the organization.⁵

Organizational Sector

Because the projects under investigation come from government, non-profit, and industrial sectors, it is important to see if the findings favoring balance for internal influence and project dominance for organizational influence are supported across all of these. For internal influence, the findings remain consistent across the three sectors. In both the industry and government projects, performance was highest when the locus of influence over project work was balanced. Only projects in the non-profit sector failed to show higher performance with balanced work influence. In this instance, performance was independent of the locus of influence. This same pattern of results is found for

influence over personnel assignments. The findings for salaries and promotions strengthen the case for balanced management even further in that higher performance is associated with balanced influence in both the industrial and non-profit sectors. The government sector provided the only exception to this normative pattern. In that portion of the sample comprising government projects, higher performance was connected to the project manager's control over salaries and promotions rather than with balanced management. In any event, this was the only internal situation in which either functional or project dominance produced better results than balance.

After aggregating the three measures of internal influence, it is very clear that balanced involvement on the part of both managers is most conducive to higher performance (Figure 3). In all three sectors, the more highly evaluated projects are those in which project and functional managers are seen to influence internal affairs to an equivalent degree.

While balanced management may be the prescriptive norm for internal influence, the data displayed through Figure 4 show a very different but very consistent pattern of performance for organizational influence outside the project. In both the industrial and non-profit sectors, performance is consistently higher when project managers are perceived to be more influential within the larger organization. This similarity in findings goes even further in that projects in which the locus of organizational influence is seen as relatively balanced are the lowest in performance in both sectors by a considerable amount. Such consistency is somewhat surprising, especially in light of our initial expectations regarding the importance of balanced management for matrixed project members. Unfortunately, these findings could not be examined within the

LEGEND

F = Projects With Dominant Functional Managers
B = Projects With Balanced Management
P = Projects With Dominant Project Managers

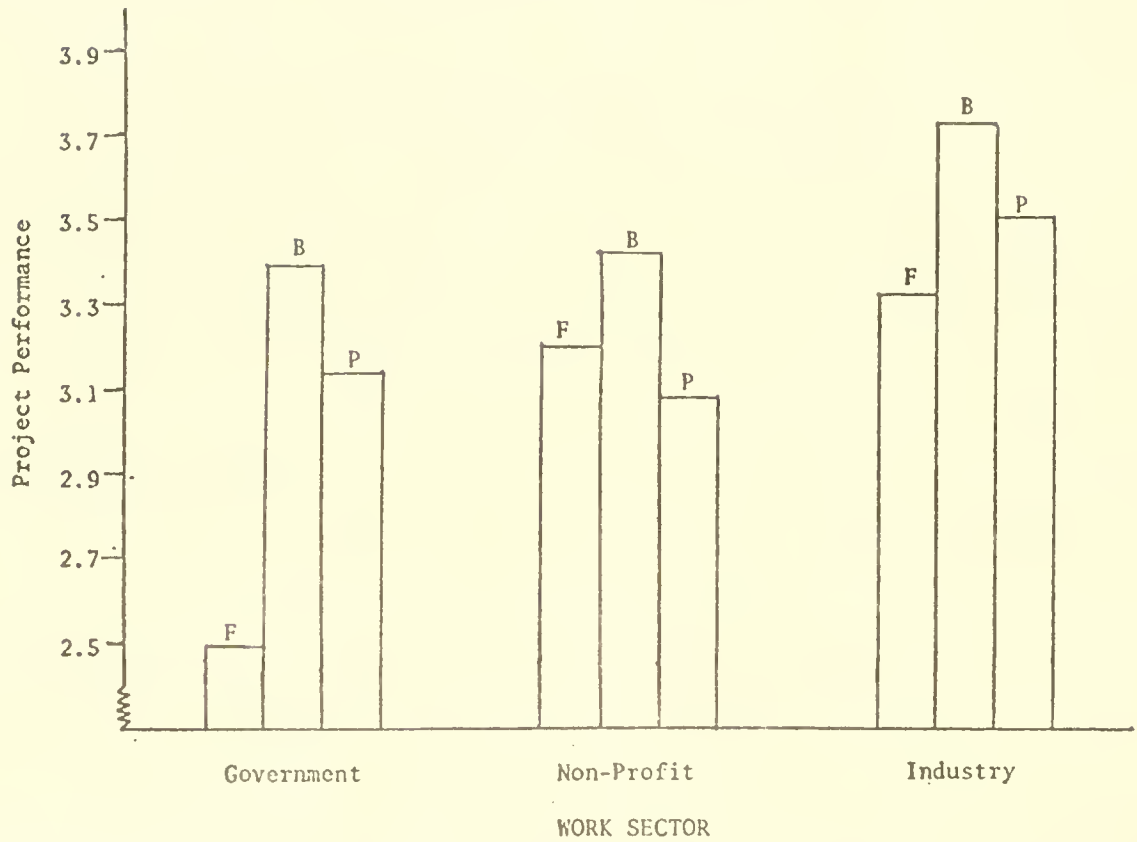


Figure 3. Project Performance as a Function of Managerial Dominance in Internal Influence

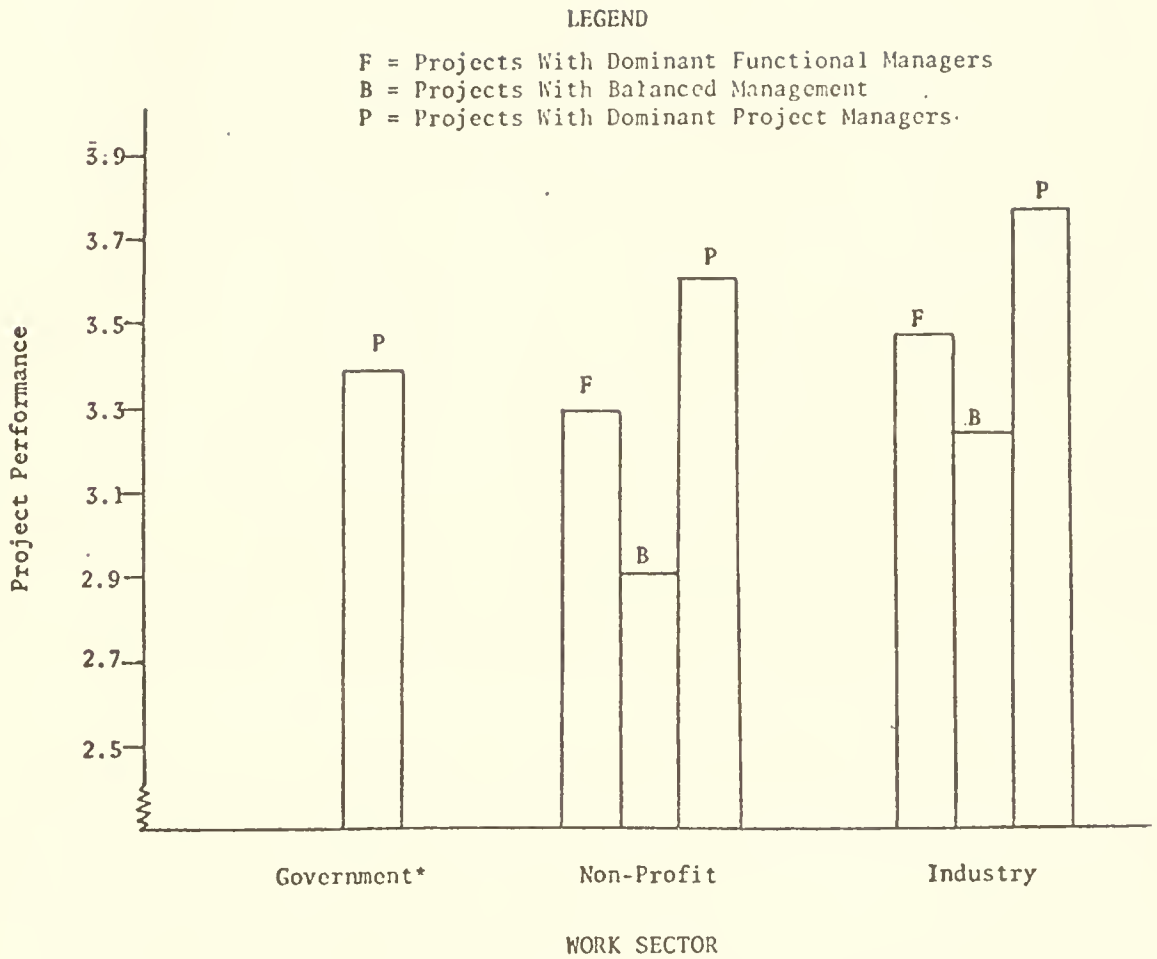


Figure 4. Project Performance as a Function of Managerial Dominance in Organizational Influence

*In the Government Sector, all our projects had dominant project managers with respect to organizational influence.

government sector as all government projects had organizationally dominant project managers.

DISCUSSION

Through all of the conditions that have been considered, a very consistent pattern of results emerges from the data. When concern is focused on the internal affairs of matrixed project members, both functional and project managers must be seen as sharing responsibility and involvement in order to achieve more effective performance. This conclusion is supported for projects in all three sectors: government, non-profit, and industry. There has to be someone concerned with getting the results out and satisfying "customer needs", and there has to be someone concerned with technical integrity, insuring that appropriate technologies are incorporated into the final outputs. When both of these people have influence over project activities, i.e., project work, remuneration and promotion, and personnel assignments, the performance results are better.

Despite this consistent finding, most projects in our sample are not balanced with respect to internal influence. The details of project work, for example, are dominated by project managers. This may not be particularly surprising since it is the project manager who manages the output and who is ultimately responsible for the project's results. Functional managers, however, are not without their responsibilities, for they manage the inputs and presumably know more about the specific technologies. Yet, project managers tend to dominate the technical

details of what goes on in most of the project teams. This may be a natural tendency since it is the project manager's reputation and career that are most intimately tied to project outcomes. Nevertheless, performance would be improved if project managers would accept greater influence from functional managers who have engineering personnel assigned to their projects.

In sharp contrast to project work, matrixed professionals claim that functional managers have almost exclusive control over pay and organizational advancements. This may not mean that project managers, in fact, have no influence. They may well have been consulted in great detail. It is what engineers perceive that is important, for their efforts and attitudes are very sensitive to who they think controls their rewards. Some of this functional bias is probably based on the fact that functional managers are alone in their offices when engineers are called in for their reviews or for the announcement of their raises or promotions, thereby, limiting perceptions of the project manager's actual role in this process. As might be expected, functional managers are also seen by most matrixed engineers as having more control over their selection to work on particular projects. Both of these situations, however, are at odds with what the normative results recommend. Performance is likely to be enhanced when greater balance in these internal areas of influence is achieved.

Unlike internal influence and contrary to the formulated hypothesis, project performance is highest when matrixed personnel view their project managers as having greater organizational influence. This finding was strong and consistent across the different work sectors. Moreover, even when functional managers are seen to exert more influence in the

organization, performance is considerably higher than when both managers were equally influential in the organization. A balanced locus of organizational influence produced the lowest performing group of projects. One of the two managers, then, should be clearly dominant within the larger organization. Matrixed engineers have to see themselves connected to the organization through some power base. The link can be either through the project or functional side of the organization but there should be little ambiguity over it. When that power was seen as operating through the project manager, the effect on performance was greatest.

Why should performance be higher when project managers are seen as more powerful within the organization than their functional peers? Are organizationally dominant project managers seen as doing something different from or more effective than the other project managers? The exploratory findings with respect to managerial functions suggest that project managers who have greater influence in the organization may have higher performing projects because they have greater access to resources and are able to handle conflict situations more effectively. But perhaps most important, they are sufficiently well connected and visible to draw the attention to higher management. Top management support has been shown to be an extremely important ingredient in project success (Achilladeles et al., 1971). The ability to perform these functions, then, should be important considerations in the selection of project managers.

CONCLUSIONS

In an R&D organization, the underlying purpose of the matrix is to give formal recognition to the need to satisfy both input and output-oriented forces. The findings suggest that it is not only possible to have both forces operating but that more successful performance is likely to result when these forces are seen as mutually influential over internal project affairs. While such conflicts may be advantageous with respect to internal influence, they are not advantageous when it comes to organizational influence. By a wide margin, organizationally dominant project managers have the highest performing project teams. These project managers not only fulfill a number of important managerial functions more effectively, but this clear and unambiguous picture of organizational influence may also be essential for allowing matrixed individuals to tolerate and deal with their internal conflicts. The organizationally dominant project manager provides the stability that enables one to confront and resolve internal conflicts more effectively--a kind of creative tension (Kuhn, 1963) between organizational stability and internal tension.

Finally, it should be reemphasized that the current state of affairs does not coincide very well with these normative findings. Furthermore, in working over the years with a large number of high level R&D managers, we consistently hear that matrix structures are often needed but that they are also very frustrating and very troublesome; in short, a kind of necessary evil. Perhaps these frustrations can be reduced as we learn more about how to properly manage this very complex organization form.

Proponents of matrix designs, as well as our own initial hypothesis, have long argued that organizational power must be balanced. The results here suggest that this may not be a very desirable route. Perhaps it is our misunderstanding of how internal and external influences need to be combined and complemented that has led to so many difficulties in implementing and maintaining matrix-type designs effectively. Clearly, a great deal more research is needed to unravel these problems; and hopefully, the findings presented here will be a step in that direction.

FOOTNOTES

1. This study is part of a large research effort conducted under U.S. Army sponsorship. A more complete description can be found in Katz and Allen (1978).
2. This personalized distribution was necessary to make sure that each project member received the correct questionnaire form.
3. On any particular question, however, the number of project groups for which we have complete data ranged from 66 to 92.
4. Most likely, there is considerable candor in these evaluations. Managers were willing to give almost as many low ratings as high ones.
5. Recent work in RD&E laboratories by Roberts and Fusfeld (1981) has revealed a number of critical functions that need to be performed within a laboratory if it is to remain innovative. While some of these functions, i.e., the entrepreneurial, gatekeeping, mentoring, and product champion roles, were not included in the present study, future research should see if and how these roles affect perceptions of internal and external influence.

REFERENCES

- Achilladeles, A., Jervis, P., and Robertson, A. (1971) Success and Failure in Innovation, Project Sappho, Sussex: University of Sussex Press.
- Allen, T.J. (1977) Managing the Flow of Technolgy, Cambridge, MA: M.I.T. Press.
- Davis, S. and Lawrence, P. (1977) Matrix, Reading, MA: Addison-Wesley.
- Hill, R.E. and White, R.J. (ed.), (1979) Matrix Organization and Project Management, Ann Arbor: University of Michigan Press.
- Katz, R. and Allen, T.J. (1978) The Technical Performance of Long Duration R&D Project Groups. Technical report to the Chief of Studies Management Office, Department of the Army.
- Katz, R. and Tushman, M. (1979) Communication patterns, project performance, and task characteristics: An empirical evaluation and integration in an R&D setting. Organizational Behavior and Human Performance, 23, 139-162.
- Katz, R. and Tushman, M. (1981) An investigation into the managerial roles and career paths of gatekeepers and project supervisors in a major R&D facility. R&D Management, 11:3, 103-110.
- Kingdon, O.R. (1973) Matrix Organization: Managing Information Technologies. London: Tavistock.
- Kuhn, T.S. (1963) The Structure of Scientific Revolutions. Chicago: University of Chicago Press.
- Lawrence, P.R. and Lorsch, J.W. (1967) Organization and Environment. Boston: Harvard Business School.
- Likert, R. (1967) The Human Organization. New York: McGraw-Hill.
- Mansfield, E. and Wagner, S. (1975) Organizational and strategic factors associated with probability of success in industrial research. Journal of Business, Winter, 179-198.
- Marquis, D. (1969) Ways of organizing projects. Innovation, 5, 26-33.
- Roberts, E.B. and Fusfeld, A.R. (1981) Critical functions: Needed roles in the innovation process. In R. Katz (ed.) Career Issues in Human Resource Management. Englewood Cliffs, N.J.: Prentice-Hall.
- Sayles, L.R. (1976) Matrix Management: The Structure with a Future. Organizational Dynamics, Autum, 2-17.
- Souder, W.E. (ed.) (1979) Special issues on project management. IEEE Transactions on Engineering Management, 26:3, 49-87.
- Utterback, J. (1974) Innovation in industry and the diffusion of technology. Science, 183, 620-625.

1985
MAY 22 '84

MAY 22 '84

MAY 8 1985

MAY 28 '86

BASEMENT
Date Due

MAY 11 1987

MAY 11 1987

MAY 11 1987

APR 05 1981

FEB 1 9 2000

HD28.M414 no.1233- 81
Katz, Ralph. /Project performance and
742962 D*BKS 00133584



3 9080 002 007 661

